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Forensic Autopsy

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Introduction

A forensic autopsy is an examination conducted postmortem to address medicolegal objectives. A forensic autopsy is also called a medicolegal autopsy. The performance of a forensic autopsy follows instructions from the concerned legal authority responsible for the medicolegal investigation of sudden, unexpected, suspicious, mysterious, unwitnessed, obscure, unexplained, or litigious deaths, criminal deaths, industrial deaths, and deaths associated with medical or surgical treatment where medical negligence is alleged or anesthetic deaths. In brief, all deaths of unnatural (homicide, suicide, accident) manner, suspicious deaths, and unexpected deaths necessitate a legal investigation, which includes an autopsy as a portion of the evidence-gathering process.

The legal authority directing the autopsy surgeon/forensic pathologist to conduct the forensic autopsy may be the coroner, the medical examiner, the magistrate, the police, or the procurator fiscal as the legal norms differ substantially across the globe. The performance of a forensic autopsy forms a part of the medicolegal death investigation system. The type of medicolegal death investigation system varies from one country to another and may even differ within a country. For instance, in the United States of America, the coroner system and medical examiner system of medicolegal death investigation are prevalent. In India, either the magistrate or the police conduct the medicolegal death investigation. In Scotland, the procurator fiscal investigates deaths requiring further explanation. In the other regions (England, Wales, and Northern Ireland) of the United Kingdom, the coroner investigates deaths demanding further explanation.

Issues of Concern

Aims and Objectives of a Forensic Autopsy

The aims and objectives of a forensic autopsy differ from one case to another and can be specific for a particular case. Nevertheless, in general, the following are the objectives of conducting a forensic autopsy:

- To establish the identity of the dead
- To determine the cause of death
- To assist in confirming or refuting the alleged manner of death, wherever possible
- To estimate the time since death (postmortem interval)

Establishing the identity of the deceased is of paramount importance while conducting a forensic autopsy on an unknown body. At times, confirming the identity of the deceased also matters.

The cause of death occurs either as an injury in cases of violent deaths or by disease in cases of natural deaths. The cause of death can be either natural or unnatural. For example, if a head injury is the cause of death broadly, then how

the head injury occurred can be accidental, suicidal, or homicidal. Death from a head injury can result from an accidental fall from a height, or a suicidal jump from the top of a tall structure, or a deliberate push from the roof terrace, in which this last case the manner of death is considered homicidal. To be more precise, let us consider subarachnoid hemorrhage as the cause of death. Subarachnoid hemorrhage can result from a spontaneous rupture of a berry aneurysm (natural mannered death) or can be secondary to blunt force impact to the head (unnatural mannered death).

However, it is noteworthy that the final verdict regarding the manner of death is decided by the Court of Law in most jurisdictions worldwide since opinion on the manner of death is based not just on medical evidence but more so on other circumstantial pieces of evidence. Medical evidence is only one piece of the puzzle.

In the case of a fetal autopsy or an autopsy of a neonate, the following are the specific medicolegal objectives:

- To determine the intra-uterine/gestational age of the fetus, ultimately aiming to know whether the fetus was viable or not (to assess the viability of the fetus)
- If viable, to determine whether it was born alive (live birth) or dead (dead birth/stillbirth)
- If born alive, to determine the period of survival after birth, the cause, and manner of death

In the case of a body fished out of the water, one of the specific medicolegal objectives of conducting an autopsy is to determine whether the cause of death was drowning or whether the person died by some other means and then the body dumped in the water to conceal the crime. A similar concern is in cases of a simulated hanging where the perpetrators of a homicide present it as a suicide. In the case of a conflagration in a building, the specific medicolegal objectives of conducting an autopsy are to determine whether the person died of burns or otherwise (for example, fall of masonry while in a building on fire or inhalation of irrespirable gases) and to differentiate antemortem burns from postmortem burns. Autopsy finding of the presence of soot particles in the distal airways and autopsy ancillary investigation finding of the presence of carboxyhemoglobin (COHb) in the blood do not necessarily prove that the body surface burns are antemortem, but that the victim was alive when the fire was in progress,[1] which is not the same conclusion. A dead body recovered from a fire may present with cutaneous burns sustained before death or after death or at both times. Continued application of fire to skin after death vs. skin burnt before death usually obscures the antemortem features of burns and poses a challenge to the forensic pathologist in determining the nature of burns. Such a situation may arise even in air-crash incidents where there is a fire. At times, the testimony (related to the nature of burns and cause of death) of the forensic expert at the Special Court of Inquiry proceedings held in circumstances of an air-crash incident are misunderstood by lay media personnel and wrongly published in the daily newspapers.

It isn't always straightforward to opine the cause of death in forensic practice. To quote from Professor Stephen Cordner's article published in the Lancet, "*Substantial delay between injury and death, non-fatal injury precipitating death in a relatively short time from natural causes, a peculiarity of the victim rendering a survivable injury fatal*" are realities often encountered in forensic autopsies.[2] Autopsy surgeons also commonly encounter cases where the pathological evidence of injury or disease is obliterated by advanced postmortem changes and occasionally cases where the opinion regarding the cause of death is entirely dependent on the interpretation of circumstantial evidence.[2] Moreover, they often see instances with multiple competing potential causes of death in autopsy practice.[3]

Preliminaries/Formalities of a Forensic Autopsy

- To conduct a forensic autopsy, informed consent of the legal heirs/relatives is not necessary, as the aim of checking for any felonious component involved in the death would get bogged down if the refusal of possibly culpable persons could prevent the performance of the forensic autopsy. Nevertheless, as a matter of formality, it is a custom to inform the legal heirs about the performance of the forensic autopsy. The body to be autopsied is handed over to the autopsy surgeon/forensic pathologist by the legal authority, and the forensic team returns the

autopsied body to the legal authority. The legal authority then formally hands over the body to the legal heirs for the last rites to be performed. In all circumstances, it is necessary to document the chain of custody of the dead body.

- No casual observer should be present during a forensic autopsy. A register consisting of the names of those persons legally entitled to be present during a forensic autopsy should be maintained.
- The best location for a forensic autopsy is a well-equipped, well-ventilated, and well-illuminated autopsy-room adjacent to the mortuary. Nonetheless, forensic autopsies are also conducted at the scene of the discovery of a decomposed body, site of exhumation of a dead body, or in make-shift arrangements organized at the site of mass-disasters, depending on the circumstances.
- Forensic autopsies should be the purview of doctors trained and certified in the specialty of forensics. Nevertheless, in the developing world, it is not uncommon for doctors to lack specific training in forensics to conduct autopsies when a trained forensic autopsy surgeon is not available, especially in rural and remote regions of a vast country.[4][5]

The Autopsy Surgeon/Forensic Pathologist

The significance of the powers of observation and interpretation of autopsy findings, awareness of different possibilities, and a flexible and open mind of the autopsy surgeon is always stressed.[6] The failure to maintain a high standard of care of postmortem examination due to a low level of competency in forensic pathology can lead to mistakes in opinions concluded by the autopsy surgeon causing errors and, ultimately, injustice.[6] The literature reports forensic autopsy cases with erroneous opinions related to the cause of death, which further emphasizes the requirement of adequate training of the autopsy surgeon.[5]

The Procedure of a Forensic Autopsy

A complete or full autopsy is necessary to ascertain the definitive cause of death.[7] Incomplete autopsies, including limited autopsies, needle autopsies, or endoscopic autopsies that are comparatively less invasive or non-invasive, are not routinely part of forensic practice.[7] Nevertheless, the legal authority can sanction postmortem examinations that are not complete.[8] In incidents of mass disasters where identification of the deceased is the priority, only external postmortem examination with or without being followed up by ancillary investigations related to forensic identification takes place at times in the developing world.[8] In such circumstances of mass disasters where comparative DNA analysis is not an option, non-identification or misidentification of the deceased is not uncommon.[8] Recommendations are that DNA-based identification of all the victims of mass disasters be made mandatory and considered in addition to other corroborative findings related to identification even in a developing country.[8] A complete autopsy on the bodies of the pilot and co-pilot in an air-crash incident is a must as it can discover pilot-related factors (for example, a disease condition causing sudden natural death, the presence of alcohol or drugs on the toxicological analysis) that can cause the air-crash disaster.[9] A complete autopsy on the bodies of other air-passengers is not mandatory in many jurisdictions across the globe.

A complete forensic autopsy includes an external examination of the body (including the examination of clothes and accessories on the body), internal examination, and collection and preservation of various material for any indicated ancillary investigations.

The anteriorly placed *I-shaped incision* is the most common body surface skin incision employed to open up the thoracic and abdominal cavities. The other two commonly employed conventional skin incisions include the *Y-shaped incision* and *modified Y-shaped incision*.[10] The reflection of the skin by an *X-shaped incision* of the back and limbs is useful to detect and evaluate hidden subcutaneous hemorrhages in custodial deaths.[11]

The coronal incision is the commonly employed skin incision employed to open up the cranial cavity. The scalp is incised in the coronal plane, beginning at the mastoid process, behind the ear, running across the vertex, to reach the

opposite mastoid. Thus a bi-mastoid incision of the scalp along the coronal plane is employed.

The following are the four illustrated autopsy techniques that are described in the "*Handbook of Autopsy Practice*" by Jurgen Ludwig and elsewhere.[12]

1. Technique of Virchow
    - This technique employs organ removal, one by one
2. Technique of Rokitansky
    - This technique uses in-situ dissection of organs
3. Technique of Ghon
    - In this technique, cervical and thoracic organs, organs in the abdomen, and the urogenital system undergo removal as separate organ blocks ("*en bloc*" removal)
4. Technique of Letulle
    - A technique wherein the removal of the cervical, thoracic and abdominal organs is as a single organ block ("*en masse*" removal) is the usual practice.

In addition to a complete and meticulous dissection of the dead body, the following should also be taken care of as a part of a forensic autopsy:

- Obtaining photographs and video films for future evidential use in the Court of Law
- Retaining samples (body viscera and fluids) for chemical/toxicological analysis, histopathological/microscopic examination, and/or other ancillary investigations as stated above
- Restoring the autopsied body to the best possible cosmetic condition before handing over to the concerned legal authority
- Providing a detailed written postmortem examination report of the autopsy findings and their inferences concluded based on scientific reasoning.

The commonly considered autopsy ancillary investigations include chemical/toxicological analysis of body viscera and fluids and histopathological/microscopic examination of various organs.

The other ancillary investigations (not an inclusive list) include the examination of:

- Blood for grouping
- Viscera and blood for microbiological culture
- Body fluids for postmortem chemistry (thanatochemistry)
    - For example, evaluation of the potassium levels in the vitreous humor is useful in estimating the time since death during an autopsy in the early postmortem period.
- Vaginal swabs, anal swabs, swabs from bite marks, etc
- Stains on the skin or fabric/clothing
- Material for DNA typing

Clinical Significance

Sudden and unexplained deaths and mysterious and suspicious deaths should be reported to the concerned legal authority. In such circumstances, there should be no issue of a death certificate (cause of death certificate) without a formal medicolegal death investigation by the legal authority. Deaths that appear to be non-criminal deaths at first can turn out to be criminal-deaths on further investigation.

Other Issues

Negative Autopsy

An autopsy without any positive findings that fail to reveal the cause of death with gross, microscopic, toxicological, and other necessary ancillary investigation is said to be a negative autopsy.

Obscure Autopsy

A complete, meticulous autopsy with its ancillaries that fails to serve the purpose of ascertaining the cause of death, despite the presence of trivial/unclear/obscure findings, is termed an obscure autopsy. An ill-informed opinion often turns out to be worse than no opinion at all. Absent an opinion, the legal authority investigating the death will be at least aware of the lacunae in his/her evidence/investigation, rather than deceived by the speculative or orchestrated statements made by the autopsy surgeon/forensic pathologist.

In general, a negative or obscure autopsy is one where the cause of death remains unascertained despite a complete, meticulous autopsy, including ancillary laboratory tests. Such autopsies where the cause of death remains undermined despite a meticulous workup of the cases are not uncommon in forensic practice.[13][14] With advanced laboratory investigation techniques, the cause of death in otherwise obscure autopsies is determined.[15] Nevertheless, forensic autopsies may conclude as either negative or obscure, even in recent times.

Second Autopsy

A second autopsy is the one that follows the first autopsy on the same body. Some of the circumstances for a second autopsy include a repatriated body and exhumation of a previously autopsied body.[16][17]

Exhumation

Exhumation is the lawful disinterment of a previously buried body, for medicolegal purposes, where a postmortem examination is an imperative task. The exhumation is followed by either the first autopsy or a re-autopsy in light of new suspicious information.[18][17] AN exhumation followed by an autopsy conducted for medicolegal purposes is also an important tool for education and training of forensic specialty related residents or postgraduate students.[19]

Exhumations are usually carried out for one of the following reasons[18][20][21][22][23][24]:

- Where new relevant information or substantiated allegations suggesting death due to criminal action, either from poison or injury, arise:
    - For instance, in Tunisia, a body buried in 1979 without an autopsy was exhumed in 2011 more than 30 years later as the relatives were doubtful of the reported cause of death.
    - A forensic autopsy conducted on an exhumed body in Switzerland a year after burial revealed the actual cause of death with the revision of the manner of death from natural to accidental
    - The first president of the Palestinian National Authority, Yasser Arafat's remains were exhumed in 2012 - the new probe into Arafat's 2004 death came after a Swiss laboratory reported traces of a deadly radioactive isotope, polonium-210, on his clothing.
- Where confirmation of identity is deemed necessary for various civil and criminal purposes
- Where the first postmortem examination report is inexplicable or ambiguous

Stringent measures must be in place to identify the grave and the coffin (if applicable) so that there is no mistake in exhuming the body to be autopsied.[25]

Autopsy Artifacts

The interpretation of the external and internal postmortem examination findings is of utmost importance to the criminal justice system as the autopsy surgeon's expert opinion has a bearing on the outcome of the case decided by the Court of Law. In this context, the autopsy surgeon should be aware of artifacts (resuscitation artifacts, agonal artifacts, and postmortem artifacts) that may be present during an autopsy.

To quote, "*A postmortem artifact is regarded as any change produced in the body or any feature introduced into the body, after death, that often leads to much confusion about its nature and causation, and often results in misinterpretation of medicolegally significant antemortem findings or is itself wrongly considered as a significant antemortem finding*".[26] The changes that occur during the agonal period and the injuries introduced during resuscitative measures may also pose interpretative difficulties to the autopsy surgeon.[27][28]

Enhancing Healthcare Team Outcomes

The performance of a forensic autopsy as a part of the medicolegal death investigation is of paramount significance in understanding the circumstances of death in every civilized society. In many jurisdictions across the globe, the performance of a forensic autopsy is required cases of unnatural deaths, deaths from sudden natural causes, and deaths occurring under suspicious or unusual circumstances. Although the medicolegal death investigation system and forensic autopsy standards differ from country to country, the aims and objectives primarily remain the same.

Forensic experts are proud to note that forensic autopsies have contributed significantly to the cause of justice and service of humanity over the years. All members of the healthcare team, including non-forensic doctors and nurses operating in an interprofessional team environment, should be aware of death from unusual or suspicious circumstances and refer these cases for a forensic autopsy. [Level 5]

Review Questions

- Access free multiple choice questions on this topic.
- Comment on this article.

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